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BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking on the Commission's Proposed Policies and Programs Governing Low-Income Assistance Programs.	Rulemaking 01-08-027

ASSIGNED COMMISSIONER'S RULING AUGMENTATION OF THE BUDGET FOR PHASE 3 OF THE LOW INCOME ENERGY EFFICIENCY STANDARDIZATION PROJECT AND REVISED PHASE 4 STANDARDIZATION PROJECT WORKPLAN

This ruling approves an augmentation of the budget for Phase 3 of the Low Income Energy Efficiency (LIEE) Standardization Project and a modification of the joint utilities' Low Income Energy Efficiency Program Standardization Team's Revised Phase 4 Workplan ("revised workplan"). The joint utilities are: Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas & Electric Company (SDG&E) and Southern California Gas Company.

In Decision (D.) 01-03-028, the Commission determined that natural gas appliance testing procedures should be further examined as part of ongoing efforts to standardize the policies and procedures of low-income energy efficiency programs. For this purpose, the Commission directed the Standardization Project Team to conduct a study of natural gas appliance safety conditions and alternative natural gas appliance safety testing procedures during Phase 4 of the Standardization Project.[1] The Commission authorized the utilities

[1] The Standardization Project Team consists of the joint utilities and their technical consultants. Energy Division assists in coordinating the effort. Per Commission

Footnote continued on next page

to augment the team with additional project consultants, as needed, and delegated to me the task of directing the project team with regard to the scope of work, budget and schedule for Phase 4. The goal is to have Phase 4 completed in time so that the Commission can further consider natural gas appliance testing issues during the program year 2004 program planning cycle. [2]

On November 13, 2001, I issued a ruling approving, in part, the joint utilities' Proposed Workplan for Phase IV of the Low Income Energy Efficiency Program Statewide Standardization Project ("proposed workplan").[3] In addition to the tasks that were directed by the Commission, the joint utilities' proposed Optional Tasks 10 and 10a were approved in concept, pending the Commission's final determinations on an assessment methodology. The joint utilities' proposed Optional Task 10b was not approved. In my November 13th ruling, I indicated that the joint utilities should submit modifications to their proposed budget and schedule for Tasks 10 and 10a, if needed, when the Commission issued a final decision in Phase 3. In the interim, I ordered the joint utilities to file a revised workplan and budget for the remainder of the approved tasks and instructed the utilities to remove any funding requests related to tasks not approved by the ruling.

On November 26, 2001, SDG&E, on behalf of the joint utilities, filed the revised workplan for all of the tasks approved in my November 13th ruling. The

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direction, the project team obtains input from the public before submitting final recommendations to the Commission.

[2] *See* D.01-03-028, *mimeo.* pp. 30-34.

[3] On September 4, 2001, Sempra Energy, on behalf of the joint utilities, submitted the proposed workplan to the Commission.

revised workplan included a general list of activities to complete Task 10.[4] The joint utilities propose a budget of $54,600 in the revised workplan to complete Task 10, $10,000 less than the budget for Task 10, 10a and 10b in the proposed workplan. The joint utilities did not include the former proposed Task 10b in their revised workplan and removed funding requests associated with this task in the budget line item for Task 10.

The joint utilities did not reduce the budget requested for Task 12, additional meetings, workshops and reply comments that might be necessitated by performing Tasks 9-12, even though they will not be implementing Task 10b, at this time. However, it is reasonable that the number of meetings, workshops and reply comments would not be reduced because Task 10b would have occurred simultaneously with the implementation of Tasks 10 and 10a. Therefore, it is reasonable that the joint utilities did not reduce the budget for Task 12.

In my November 13th ruling, I requested that the utilities correct a typographical error in the schedule for Task 9 and that the joint utilities' proposed standards for refrigerator grounding, Task 11, be filed with the Commission's Docket Office and served on all parties as soon as possible. In their revised workplan, the joint utilities corrected the typographical error and indicated that the installation standards for refrigerator grounding will be completed on January 15, 2002, and submitted to the Commission and parties soon thereafter.

[4] Task 10 of the revised workplan is the former Task 10 and 10a of the proposed workplan

On November 29, 2001, SDG&E, on behalf of the joint utilities, filed comments on my draft decision, in Rulemaking 01-08-027.[5] In their comments, the joint utilities requested an augmentation to the Phase 3 budget of $122,502. The joint utilities noted that the Phase 3 filing process proved considerably more extensive than initially anticipated. Secondly, the joint utilities pointed out that the draft decision, if adopted, would entail the use of additional consultant time to develop new recommendations on cost-effectiveness criteria and would therefore require an augmentation to the budget to complete these tasks. Thirdly, the joint utilities indicated, that in the course of Phase 3, it was necessary to develop installation standards for the addition of air conditioner replacement as a new and rapid deployment measure.

Much of the additional Phase 3 work tasks, cited by the joint utilities in their comments on the draft decision, was assigned by the Commission or was due to unexpected complications. These tasks were unanticipated and increased the volume and scope of work. Most of Phase 3 is complete and was adopted by the Commission in D.01-12-020, the Commission's interim decision in Phase 3.[6] Information provided by the joint utilities in their comments and reply comments was helpful to the Commission in sorting through the issues and developing the procedures and policies established in D.01-12-020. The Commission did order the joint utilities to include air conditioner replacement as

[5] Draft Interim Opinion on Low-Income Energy Efficiency Project (Phase 3), Calculations for Bill Savings and Reporting Requirements Manual (Phase 2), Including Cost-Effectiveness Testing of Low-income Programs, issued on November 9, 2001.

[6] D.01-12-020, the Interim Opinion: Low Income Energy Efficiency Standardization Project (Phase 3), Calculations for Bill Savings and Reporting requirements Manual (Phase 2), Including Cost-Effectiveness Testing of Low-Income Programs, issued on December 11, 2001.

a rapid deployment measure,[7] and this task was not was not part of the Phase 3 Workplan.[8] The outstanding task of developing a new cost-effectiveness methodology is of prime importance because the Commission and various parties will be relying on this methodology for assessing each of the program measures for continuance in the LIEE program. Therefore, it is reasonable to approve the increase in the Phase 3 budget for the requested activities.

On January 4, 2002, SDG&E, on behalf of the joint utilities, submitted a letter requesting that the preliminary Phase 4 budget approved by my November 13th Assigned Commissioner's Ruling be augmented by $30,000 and that the schedule for Task 10 of the revised workplan be extended.

The joint utilities point out that in their initial and revised workplan, they had not requested resources for the acquisition of carbon monoxide (CO) real-time data measurement equipment because they intended to borrow the necessary equipment from each utility's equipment lending library. In their January 4th letter, the joint utilities indicate that the utilities' existing equipment will not provide the accuracy required by this project. The joint utilities assert that they have located a moderately priced, accurate, real-time measurement device at a moderate price of $30,000 for the 30 data loggers that will be needed to complete the project.

I commend the utilities for striving to keep the costs of the project down by agreeing to loan the project the 30 data loggers needed to complete the Phase 4 project. It is unfortunate that these loggers will not produce the accuracy

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[7] *See* D.01-05-033, mimeo. pp. 30-37.

[8] *See* Assigned Commissioner Lynch's Ruling on Low-Income Energy Efficiency Standardization Project, dated June 6, 2001, *mimeo.* p. 3.

required. Accuracy in the measurement of CO levels in the 30 test homes is of paramount importance. Moderately priced equipment, for a total of $30,000, is a relatively insignificant cost in relation to the total costs for this project. Approving this cost is reasonable in that these loggers will provide the necessary measurements. This equipment, when the project is completed, should be donated to the utilities' low-income energy efficiency equipment libraries.

The Commission, in its interim Phase 3 decision, did not approve the joint utilities' proposed LIEE program cost-effectiveness methodology. Instead, the Commission referred the issue of how the LIEE program should be evaluated back to the Reporting Requirements Manual Working Group and the Standardization Project Team for further analysis and recommendations.[9]

With respect to the January 4th requested schedule extension for Task 10, the joint utilities point out that the initial and revised work scope submitted by the utilities, with a February 1, 2002 completion date, was based on an assumption that the Commission would approve a LIEE program cost-effectiveness methodology in its final Phase 3 Decision. The joint utilities now propose that the submission date for Task 10 be within 90 days of the date of the Commission's ruling adopting firm program and measure cost-effectiveness tests.

The joint utilities' request to extend the schedule for the completion of Task 10 is reasonable in light of the incomplete and as yet to-be-approved LIEE cost-effectiveness methodology. A reasonable timeframe to complete Task 10 is within 90 days after the adoption of LIEE cost-effectiveness methodology given

[9] *See* D.01-12-020, *mimeo.* pp. 53-60.

that the joint utilities will need to seek public input during the process. The joint utilities' request for an extension of the schedule for Task 10 should be approved.

In my November 13th ruling, I indicated that Task 10, including its budget and modified schedule was only approved in concept. Task 10 remains approved in concept only, pending the Commission's final determination on an assessment methodology. Although I am approving an extension to the preliminary schedule for Task 10 in this ruling, the joint utilities may still submit modifications to the Task 10 budget and schedule, if needed, when the Commission issues a final decision in Phase 3.

The joint utilities made all of the necessary and required changes pursuant to my November 13th ruling. Therefore, the revised workplan, modified with the above changes, is approved, and is included in this ruling as Attachment 1.

As directed by the Commission in D.01-03-028, Energy Division shall continue to coordinate these standardization efforts.

IT IS RULED that:

1. The requested augmentation to the Phase 3 budget is approved.

2. The Revised Workplan for the Phase 4 Study in the utilities' Low-Income Energy Efficiency Program Statewide Standardization Project, as presented in Attachment 1, is approved.

3. At the conclusion of Phase 4, the 30 data loggers purchased for this project shall be donated to the utilities' low-income energy efficient equipment libraries.

4. Task 10, including Task 10's budget and schedule, remains approved in concept only. The joint utilities may submit modifications to the proposed budget and schedule for Task 10, if needed, when a final decision in Phase 3 is issued.

5. Comments on all of the Phase 4 filings are due 15 days from the date of the filing, and replies are due 10 days thereafter.

6. All filings directed by this ruling shall be filed at the Commission's Docket Office and served on all appearances and the state service list in this proceeding via electronic mail. Service by US mail is optional. However, if there is no electronic mail address available, the electronic mail is returned to the sender, or the recipient informs the sender of an inability to open the document, the sender shall immediately arrange for alternate service (regular U.S. mail shall be the default, unless another means—such as overnight delivery—is mutually agreed upon.) The current service list for this proceeding is available on the Commission's web page, www.cpuc.ca.gov.

Dated February 19, 2002, at San Francisco, California.

/s/ CARL W. WOOD
Carl W. Wood
Assigned Commissioner

CERTIFICATE OF SERVICE

I certify that I have by mail, and by electronic mail to the parties to which an electronic mail address has been provided, this day served a true copy of the original attached Assigned Commissioner's Ruling Augmentation of the Budget for Phase 3 of the Low Income Energy Efficiency Standardization Project and Revised Phase 4 Standardization Project Workplan on all parties of record in this proceeding or their attorneys of record.

Dated February 19, 2002, at San Francisco, California.

/s/ ERLINDA PULMANO
Erlinda A. Pulmano

N O T I C E

Parties should notify the Process Office, Public Utilities Commission, 505 Van Ness Avenue, Room 2000, San Francisco, CA 94102, of any change of address to insure that they continue to receive documents. You must indicate the proceeding number on the service list on which your name appears.

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If specialized accommodations for the disabled are needed, e.g., sign language interpreters, those making the arrangements must call the Public Advisor at (415) 703-2074,

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ATTACHMENT 1

ATTACHMENT 1

JOINT UTILITIES' REVISED PHASE 4 WORKPLAN

Objectives of Phase 4

The general purpose of Phase 4 is to obtain information that will allow the development of a uniform set of recommendations regarding LIEE Program standards, policies and procedures with respect to natural gas appliance testing. This information should allow the Standardization Team to make carefully reasoned and well supported recommendations to the Commission with respect to natural gas appliance testing. The study will assess the impacts, if any, on carbon monoxide (CO) and other combustion-related hazards potentially associated with typical LIEE weatherization services. In this context, the specific objectives of Phase 4 are:

1. To identify the extent to which potentially hazardous carbon monoxide (CO) levels are present in a sample of low-income homes before they are weatherized;
2. To determine the extent to which the installation of LIEE infiltration-reduction measures affects CO levels in participating homes;
3. To assess alternative testing procedures that can be used to identify high CO levels and their sources, and to identify actions that can be taken to mitigate these problems where possible;
4. If appropriate, to use the results of the study to:
    - Refine the recommended LIEE Program minimum standard for natural gas appliance testing;
    - Develop updated recommendations regarding policies and procedures for the detection and mitigation of high CO levels and other combustion-related hazards; and
    - Design recommended statewide standards for LIEE program natural gas appliance testing;
    - Develop or refine related program policy and/or procedural recommendations.
5. To develop recommendations for standardizing measure approval processes across the utilities;
6. To develop and implement the first round of the measure assessment process; pending the Commission's final determination on an assessment methodology and
7. To develop refrigerator outlet grounding standards, as needed.

Specific Research Questions

Associated with the first four of the above objectives (those relating specifically to natural gas appliance testing) are several specific research questions:

1. In low-income homes in California, what are the pre-existing levels of CO in the following locations: a) in indoor ambient air, b) in the proximity of specific appliances, c) in flue gases, and d) in the surrounding outdoor air?
2. What effect does the installation of infiltration-reduction measures have on CO levels within the home?
3. Do pre-existing or post-installation CO levels found in low-income homes represent a potential hazard to the occupants?[10] What is the frequency and duration of elevated CO levels?
4. Are the existing policies and procedures and Minimum Standard for natural gas appliance testing previously recommended by the Team and adopted on an interim basis by the Commission necessary, and, if so, are they appropriate to identify high levels of CO and other combustion-related hazards in the homes of LIEE weatherization recipients?
5. To what extent would the detection of CO problems be affected by the elimination, reduction, expansion or modification of steps included in the Minimum Standard (including the installation of CO alarms as an alternative or supplement to gas appliance testing)?
6. What modifications, if any, to the current natural gas appliance testing policies and procedures should be adopted for the LIEE Program?

General Methodology

Overview

The portion of Phase 4 relating to natural gas appliance testing will entail the following specific research steps:

- A thorough review of existing literature related to indoor carbon monoxide levels, the effects on mortality and morbidity, detection/testing approaches, the impacts of infiltration reduction, and weatherization program policies;
- The acquisition and analysis of existing data relating to current program operations; and
- The use of a detailed on-site survey to assess pre-existing CO levels, evaluate various testing approaches, and assess impacts of program-related infiltration reduction.

Tasks 1 through 8 of the overall work scope will be used to implement these steps. These tasks form the basic work scope of Phase 4. Additional Tasks 9 through 12 will address pre-approvals,

[10] At least partly on the basis of the literature review, the Study Team will recommend an operational definition of hazardous levels and durations of CO.

measure assessment, and refrigerator outlet standards. All twelve research tasks are discussed below.

Task 1. Conduct Literature Review

The first task of Phase 4 will be a review of the literature on natural gas appliance safety and carbon monoxide testing. This literature will include the following types of references:

- Studies of CO levels typically found in low-income residential buildings;
- Standards, policies and practices relating to natural gas appliance testing and CO measurement in other programs;
- Analyses of linkages, if any, between infiltration rates and CO concentrations;
- Studies relating to the relationships between CO concentrations and mortality and morbidity;
- Analyses of CO detection and monitoring procedures and devices; and
- Relevant legislation (e.g., AB 1421) and previous Commission decisions.

Given the voluminous nature of the literature in these areas, the Phase 4 team will rely on existing literature reviews (e.g., Environmental Protection Agency's (EPA) recent review, Department of Health Services (DHS) studies, etc.) to the extent possible. The American Gas Association (AGA) web site will be accessed if possible to identify relevant literature listed on that site. Studies conducted by Gas Technology Institute (GTI) and the Consumer Products Safety Commission on CO alarms and other issues related to gas appliances will also be reviewed. We will also review any salient work conducted by the Wisconsin Energy Center and Affordable Comfort, Inc., as suggested by Bob Burt of the Insulation Contractors Association in his comments on this work plan. Salient literature will be summarized, and, to the extent possible, conclusions will be developed. On the basis of this literature review, the Standardization Team will refine the specific research questions to be addressed in Phase 4.

Task 2. Survey Practices in Private Industry

Under this task, the team will survey current practices in the private appliance repair and energy efficiency services industries. The elements of this task will be:

- a survey of contractor associations on the current practices followed by private contractors in the area of natural gas appliance testing ;
- a review of contractor association policies relating to appliance testing;
- a summary of E 2183 standards on appliance installation and appliance safety; and
- a review of Lawrence Berkeley Laboratory (LBL) materials on commissioning of HVAC systems, when available.

Task 3. Review Existing Data from Other Sources

A considerable amount of data relating to CO testing and impacts of weatherization on CO levels may already have been collected in California and elsewhere. The third task of Phase 4 will

entail the acquisition and analysis of this data. Examples of data that may be useful in this step of the analysis are those available from California utility low-income programs[11], the California State Department of Community Services and Development, and the California Energy Commission.

Task 4. Prepare On-Site Survey Plan

The on-site survey plan will include three elements: the sample design, data collection forms and survey protocols. These aspects of the plan are discussed briefly below.

Task 4.a. Prepare Sample Design.

The on-site survey will be structured to collect information on a representative sample of low-income homes throughout the four joint utilities' service areas in California. The first step of this process is the identification of the sample frame, or the population of households that are eligible for the LIEE Program. Unfortunately, it is impossible to know with certainty which households in the overall population are eligible; as a consequence, indirect information on likely eligibility will have to be used to define an initial frame. Utility billing records do not actually identify customer income, but they can be used, along with other information, to develop an initial set of households likely to be eligible for the Program. One option in this regard is to integrate Census data on income at the Census tract level into billing records to identify low-income areas, and to screen households in these areas for prior participation in the Program. An alternative would be to focus on the CARE designator in the billing records, defining the initial frame as all CARE customers not yet treated through the LIEE Program.

Once the sample frame is developed, a sampling plan will be developed. It is likely that stratification of the sample will be used to improve precision of the estimates. The sampling plan will specify the targeted sample sizes by stratum. Strata will reflect geographic indicators, such as utility service area and weather area, and other data pertaining to structure type and natural gas appliance type. The overall size of the sample will be based on precision requirements. The specific stratification scheme and the definition of precision level will be developed during this stage of the project. For the purposes of developing a preliminary budget, we assume a total sample size of 850 sites, stratified by residence type and climate as shown in Table 1.

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[11] In D.01-03-028, the Commission has pointed out that "we lack consistent data from PG&E's own experience with CAS testing. Nor do we have information on the numbers and proportion of testing "fails" captured under other utilities' testing systems." (p. 33.) This task is designed to make use of such data.

Table 1: Sample Structure for Mid-Range Budget

Climate	Residence Type			
	Single Family	**Multifamily**	**Mobile Home**	**All Types**
Warm	200	150	75	425
Cold	200	150	75	425
Both Climates	400	300	150	**850**

Once the overall sample size target and individual stratum targets are determined, an initial sample of households will be drawn. In order to allow for non-response and sample attrition based on ineligibility of some members of the initial sample, the initial sample will be four times as large as the target sample.

The sample design will be submitted to the Standardization Team for its review. After the Team has been given the opportunity to make comments, the project team will revise the sample design as necessary and resubmit it to the Team in final form.

Task 4.b. Prepare Data Collection Forms

Data collection forms will be developed under Task 4. These forms will be used by surveyors to record site information during the course of the survey. The forms will be designed to collect the following types of information:

a. General Assessment

- Housing type;
- Appliance types, fuels used by each appliance, and number of appliances serving each home;
- Adequacy of combustion air venting;
- Condition of heat exchanger, flue, and vent system;
- Inspection for other potential hazards, such as:
  - Presence of gas leaks;
  - Inadequate draft;
  - Spillage;
  - Burner abnormalities;
  - Abnormal ignition/flame;
  - Return system leaks;
  - Inadequate combustion system air;
  - Flue and/or venting system defects;
  - Supply and return air system leaks;
  - Use of unvented appliance as a heater;
  - Inoperable mobile home kitchen exhaust fan.

- Depressurization caused by duct system abnormalities.

b. Carbon Monoxide (CO) Assessment

- Levels of CO, measured before and after weatherization measures are installed, at the following locations:
  - Outdoors;
  - Indoor ambient air;
  - Indoors proximate to specific appliances;
  - In flue gases.[12]
- Levels of CO associated with:
  - Type of appliance and type of fuel used by the appliance;
  - Amount of combustion air;
  - Byproducts of combustion;
  - Supply and return duct leakages.

Data collection forms will be submitted to the Standardization Team for review. Once comments have been received from the Team, the project team will revise the forms as necessary and resubmit them in final form.

Task 4.c. Develop Survey Protocols

A set of uniform protocols will be developed to guide the activities of statewide survey personnel. These protocols will include the following:

- Guidelines for assessment of the structure and data related to structural statistics;
- Occupant demographic data collection;
- Natural gas appliance examination and testing procedures;
- Data collection associated with natural gas appliance examination and testing;

These protocols will allow survey personnel to evaluate a matrix of testing procedures and equipment. Six procedures (no testing and various levels of testing) will be evaluated, and two classes of equipment will be compared.
The six test procedures are outlined below. Procedures #1 and #2 include no test, and procedures #4 through #6 include various levels of testing.

Procedure 1: Ambient CO Alarms as an Alternate or Supplement to Testing

This procedure is designed to evaluate the installation of CO alarms as an alternative or supplement to natural gas appliance safety testing. CO alarms will be installed in a subset (100)

[12] CO will be tested in the flues of all combustion appliances.

of the 850 homes included in the Natural Gas Appliance Testing Study. The alarms will be installed during, or immediately after, the outreach and assessment process. Five months later, each home will undergo CO testing using the protocol developed for Procedure #6. Thirty of these 100 homes will also be equipped with data loggers that continuously monitor CO for the five months.

Data obtained from the CO testing, the data loggers, a detailed combustion appliance zone test, and a customer survey will be analyzed and compared to the performance of the CO alarms, to assess the feasibility of CO alarms as an alternative or supplement to testing. This procedure has been divided into these four steps:

1. Draft detailed CO Alarm Study Plan
2. Acquire and install CO alarms
3. Select and install data loggers and download data
4. Draft report

These steps are described below.

Draft Detailed CO Alarm Study Plan. A detailed work plan will be drafted that includes specific details for the implementation and evaluation of the study. Specifically, the following items will be developed: forms, field procedures, installation guidelines, customer survey, data acquisition protocols, procedures for interfacing with the utility gas service department, and CO alarm selection and testing procedures.

Acquire and Install CO Alarms. Consultants shall purchase 150 alarms and test each to ensure they operate prior to their being installed in homes. The goal of the CO Alarm Study is not to test the proper function, accuracy, or reliability of the alarms, but to evaluate the feasibility of CO alarms as an alternative or supplement to gas appliance testing. An attempt will be made during the review of the literature to identify the brand(s) and model(s) of the most reliable CO alarms. The pre-installation testing conducted as part of the study will be used only to ensure that faulty units are not being installed.

From the information ascertained during Task 1 (Review of the literature) and input from four experts in the field, brands and models will be selected for installation during Phase 4. This information will be supplied to the Team with a request to purchase the 150 units. Upon Team approval, the consultant will purchase and test the 150 units. The 100 units that perform best will be installed in houses occupied by low-income clients. The other 50 units will be stored for the five-month period and tested again. The results from all of the testing performed will be used in drafting the report. The acquisition process will entail the following steps:

- Analyze results from the literature review and seek input from manufacturers and individuals involved in testing CO alarms.
- Select models and brand names to use.

- Acquire team approval to purchase.
- Purchase and test 150 units.
- Deliver units to use for installation.

CO alarms will be installed prior to the installation of weatherization measures.

Installation and Downloading of Data Loggers. In an effort to determine whether the CO alarms produce the correct audible signal when CO exists or when CO does not exist, data loggers will be installed (at the same time as CO alarms are installed) to constantly monitor CO in 30 of the 100 homes. The data loggers to be installed will monitor and record CO levels 24 hours a day for five months. These recorded levels will be compared with information from the following:

- Customer reports of alarms,
- Reports of alarms to the local authorities,
- Information derived from the customers via exit interviews when the units are removed.

Data will be downloaded from the data loggers monthly, at which time the data loggers will be recalibrated and the batteries will be replaced in an effort to ensure accuracy.

Report Findings. Upon the completion of the five-month study, a report will be generated that addresses the feasibility of installing CO alarms as an alternative or supplement to CO testing. Information used to formulate the report will include:

- Incidence of alarms, as derived from the customer survey form, reports of alarms reported to Richard Health & Associates (RHA) and the utilities, and the related responses to the CO alarm calls.
- A thorough review of the CO alarm related literature will be conducted prior to the selection of alarms to be used in the study. This review will also include input from manufacturers and experts who have tested CO alarms and have published the results of their work.
- Data from the subset of 30 homes will be downloaded from the data loggers installed in the 30 homes to continuously monitor CO for the five month period.
- Each of the 100 homes will undergo a detailed combustion appliance zone (CAZ) test (Procedure #6 below) and data will be collected relating to: the house characteristics, combustion appliance performance, vent systems, and depressurization or spillage caused by exhaust fans and duct abnormalities.

Procedure #2: Visual and Olfactory Checks and Self Reports

This minimal procedure includes a visual and olfactory check of combustion appliances, coupled with a brief interview of the customer. It will include a visual inspection of each combustion appliance for hazards, such as:

- Vent system (missing/damaged vent pipe, multiple draft hoods, etc.);
- Combustible and flammable items stored on or near appliances; and
- Evidence of improper combustion (excessive soot, charring from rollout, etc.).

An olfactory check for aldehydes and gas leaks will be conducted near each appliance. The customer interview will be used to ascertain any self-reported observations and/or symptoms that could be associated with CO.

Procedure #3: Room Ambient Test

This procedure will include the check for potential hazards and gas leaks as in procedure #2, plus an ambient air CO test will be conducted to determine the CO level (ppm) in each room containing a combustion appliance.

Procedure #4: Appliance Ambient CO Test and Staging in Winter Condition:

Procedure #4 will include those procedures outlined in #3 above (check for hazards and gas leaks and room ambient CO) plus the following:

- Appliance Ambient Air CO Test—The ambient air (not flue gas) will be tested near and around each combustion appliance.
- Staged CO Test—After the ambient air around each combustion appliance is tested, the residence will be put in a winter condition (all appliances will be operated simultaneously with all windows closed) and the ambient CO checked again in the same locations.

Procedure #5: Flue Gas CO Test and Staging in Winter Condition with Fans:

This procedure will include those activities outlined in Procedure #4 above plus the following:

- Putting the residence in winter conditions and operating all exhaust devices.
- Testing flue gas for CO: The flue gas in each combustion appliance will be tested to determine the level of CO before dilution with air. The test will be conducted before and after the house is put in the winter condition with fans operating.
- Checking each combustion appliance for adequate draft, back-drafting, and spillage.

<u>Procedure #6</u>: Complete Testing Procedure in Worst Case Condition:

The procedure will include all those activities outlined in Procedure #5 above, plus the following:

- Combustion Appliance Zone (CAZ) test
  - Conduct pressure measurement in three modes of fan/appliance operation
  - Determine "worst case" condition
- An evaluation of combustion air
  - Number and size of vents, or
  - Room/residence volume
- Visual inspection of each appliance (as applicable)
  - Cracked heat exchanger
  - Missing or defective parts
- Inspection of the air distribution system (as applicable)
  - Supply leaks
  - Return leaks
  - Depressurization caused by door closing
- Inspection of flue/vent system
  - Leaks
  - Disconnects and improper terminations
- Draft and spillage test
  - Instrumented draft test
  - Visual draft test
  - Tactile test for spillage

The protocols will be submitted to a team of experts for review and recommendations. This panel will be recruited during the course of the study design process. After the protocols have been reviewed by the team of experts and necessary modifications have been made, survey protocols will be submitted to the Standardization Team. After feedback is received from the Standardization Team, revisions will be made by the project team as necessary. The utility members of the Standardization Team will have utility gas service specialists conduct quality control/quality assurance reviews of the procedures developed by Richard Heath & Associates (RHA).

Task 5. Conduct On-Site Surveys.

One of the central tasks of Phase 4 will be the administration of an on-site survey of low-income homes. These surveys will be conducted before and after the participation of subject homes in the LIEE Program. The objectives of this task will be to accomplish the following:

- Ascertain levels of CO in test homes prior to and after weatherization;
- Determine the effects of installation of infiltration-reduction measures on CO levels and other potential gas appliance related hazards;
- Ascertain the relative accuracy and time costs of various means of detecting CO problems;
- Identify natural gas appliance safety hazards other than high levels of CO; and
- Identify and evaluate alternative means of mitigating hazards detected in the process of testing.

The on-site survey will be conducted by experienced field technicians. The following activities will be conducted as part of the on-site surveys:

- Recording structural, demographic and appliance data;
- Taking CO measurements before and after installation of weatherization measures;
- Checking for gas leaks, missing components, and improper alterations;
- Evaluating combustion air supply and venting;
- Visually inspecting heat exchanger and flue/vent system;
- Examining for dirty and improperly adjusted burners;
- Checking for delayed ignition, abnormal flame characteristics, and other combustion hazards; and
- Evaluating draft (check for inadequate draft, back-drafting, and spillage).

All homes weatherized as part of the study will receive exactly the same treatment as they would typically receive under the LIEE Program, with one exception. In the event that an appliance not currently repaired or replaced under the LIEE Program is found to be faulty in the course of the on-site tests, this appliance will be repaired or replaced prior to the installation of infiltration measures, instead of simply being red tagged and disconnected. By prearrangement with the relevant utility, RHA will call in one of the utility's service providers, and will work with the provider to ensure that the appliance is repaired or replaced in compliance with all codes and regulations. Of course, repair/replacement will require the consent of the appliance owner. Information on the incidence level and costs of such repairs/replacements will be maintained in order to assess incorporating this step into the LIEE Program. *The Team requests that it be able to use utility LIEE Program funds for this purpose for the sample of homes covered by Phase 4.*

Field Simulation. One objective of the study is to determine the effects of infiltration-reduction measures on CO levels. Infiltration measures may affect CO levels by:

- Reducing the amount of available combustion air, thus impeding complete combustion.
- Contributing to back-drafting or excessive spillage, thus creating a potentially hazardous condition.
- Exacerbating the problem if high levels of CO already exist in the home prior to weatherization.

Not all conditions may be found within the relatively small random sample of test homes that will allow each of the hypotheses listed above to be thoroughly tested. However, to the degree possible, the study will test each of these hypotheses.

It is also highly unlikely that very high CO levels will be detected in the test sample homes, and if they are, it may not be prudent to weatherize units before they are abated. There may be potential liability to the project and potential hazards to field survey team members if any homes found to have extremely high levels of CO prior to weatherization are not abated before weatherization. Thus, a vacant home will be used to test the effects of weatherization measures at various (especially extreme) CO levels. The results from the vacant test home will be compared with the other field results in the development of conclusions and recommendations.

Task 6. Analyze On-Site Data

The sixth task will entail the analysis of the data collected through the on-site survey. The following kinds of analysis will be conducted:

- Distributions of structural and household features will be constructed for sampled sites and used to infer population distributions;
- Distributions of CO levels will be developed, before and after the installation of LIEE measures;
- To the extent useful, results of CO tests will be correlated with the age of test homes, number of gas appliances in the homes, structural and other household features;
- Results of various elements of CO tests will be summarized, both before and after installation of measures, and the effectiveness of these elements in detecting problems will be assessed
- Recommendations for testing standards and policies and procedures will be derived, as appropriate;
- Recommendations for mitigating CO-related problems identified by natural gas appliance testing procedures will be prepared.

The preliminary results of the analysis of on-site data will be submitted to the team of experts for review and comment. After comments have been received, the Study Team will modify the analysis as necessary.

Task 7. Prepare Phase 4 Report

Upon the completion of the analysis, the Study Team will prepare a Phase 4 report. This report will be developed in accordance with a standard procedure used throughout the Standardization Project:

- First, Regional Economic Research, Inc. (RER) and RHA will draft a report outlining the objectives, methods, and findings of the study. The draft report will be reviewed by the team of peer experts, and refined based on comments received. This report will then be submitted to the full Standardization Team for review.
- Second, the Standardization Project Team will review the report and assess its methodology and findings. This process may entail the use of other employees of and/or consultants retained by the members of the Standardization Team. The Team will comment on the consultants' report as appropriate. To the extent possible, the Study Team will develop preliminary recommendations based on the findings of the study. If appropriate, the Study Team will also develop recommendations for changes in other policies and procedures based on the study results. If a full consensus of the Standardization Project Team on these recommendations cannot be reached, a majority position and one or more minority positions may be drafted. These positions will be incorporated into the revised report.
- Third, the Standardization Project Team will circulate the revised report to the public and solicit comments. Workshops will be held in both Northern and Southern California to permit members of the public to raise questions and/or comment on the report. Opportunities for the submittal of written comments will also be provided.
- Fourth, the Standardization Team will consider the input submitted by the public and revise the report as appropriate. This report will be filed with the Commission on or before April 4, 2003.

Task 8. Meetings, Workshops and Reply Comments

This task relates to work conducted as part of the normal regulatory process. The Team will conduct a number of meetings to discuss Phase 4. Additionally, public input will be requested through a series of public workshops. Finally, after comments on the Phase 4 report have been filed, the Team will prepare reply comments.

Task 9. Develop Recommendations for Pre-Approval Policies

In the Standardization Team's Phase 3 report, it touched on the pre-approval processes currently used by the utilities. It noted that PG&E requires utility pre-approvals of LIEE measures for all homes, while SDG&E does measure pre-approvals only on large multi-family projects. SCE has a non-utility third party perform measure approvals on all homes, while SoCalGas has the installing contractor perform measure pre-approval. The Team observed that these different practices are justified partly on the basis of differences in natural gas appliance testing. PG&E

currently conducts pre-installation combustion appliance safety (CAS) testing[13] at the same time as it pre-approves measures. Its costs of testing and measure pre-approvals are likely to be lower than would be the case for the other utilities, since the cost of CAS testing and measure pre-approvals are linked, with pre-approvals based on CAS testing results. The results of the Phase 4 study will presumably enable the Standardization Team to make further recommendations on natural gas appliance testing, and should permit reconsideration of policies relating to measure pre-approval. This task was approved by the November 13, 2001 ACR.

Task 10. Assess Current LIEE Program Measures

The Team has already completed initial assessments of the new Rapid Deployment (RD) measures using the Low-Income Public Purpose Test (LIPPT), but has not yet applied this test to standard LIEE Program measures. In the Phase 3 report, the Team indicated that "If authorized by the Commission to spend the necessary time and resources to engage in this process, the Team will apply the methodology ultimately approved by the Commission to assess all of the current LIEE Program measures under a subsequent phase of the standardization effort." (p. 6-3) This task was approved, in concept only, by the Commission's November 13, 2001 ACR, pending the Commission's final determinations on an assessment methodology. The joint utilities may submit modifications to the proposed budget and schedule for these tasks, if needed, when the Commission issues a final decision in Phase 3.

Once the Commission issues its final determinations on an assessment methodology, the Team will be able to begin the process of assessing standard LIEE Program measures. The Team will use the benefit-cost test(s) approved by the Commission to assess current LIEE Program measures. The Team will also report any problems or concerns experienced using these tests to the Commission and the RRM Working Group. This task will involve the following activities:

- Information on measure costs and energy savings will be gathered from the utilities, and will be augmented by other information, if necessary.
- Preliminary estimates of cost-effectiveness will be developed using the LIPPT and/or another (other) framework(s) approved by the Commission.
- The assumptions and results of the analysis will be made available to the public, and two workshops will be held to obtain public comments on the analysis.
- After receiving public input, the Team will make any necessary revisions in the measure assessment.
- Based on the results of the analysis, the Team will develop recommendations as to which of the current measures should be offered by the utilities. It is anticipated that

[13] All three gas utilities currently test for only one combustion byproduct, carbon monoxide, and potential natural gas leaks.

these recommendations will be filed within 90 days of the Commission's final determinations on an assessment methodology, and the Team will propose that the recommendations will apply to the subsequent year.

Task 11. Develop Installation Standards for Refrigerator Outlet Grounding

The potential need to develop LIEE program standards for refrigerator grounding was pointed out in the Team's Phase 3 Reply Comments, and the inclusion of this task in the Phase 4 work scope was authorized by the November 13, 2001 ACR. Note that in the past some manufacturers allowed the use of plug adaptors. Recently, however, all the major manufacturers have begun to require that kitchen outlets used for their products be properly grounded. In some older homes served by the LIEE Program, kitchen outlets are not properly grounded. This task will assess the efficacy of grounding these outlets to allow them to receive replacement Energy Star™ refrigerators. In the event that grounding is considered appropriate, grounding standards will be proposed for addition to the LIEE Weatherization Installation Standards Manual. It is the Team's intent to finish this task as quickly as possible, so that appropriate procedures can be implemented under the policy of Rapid Deployment.

Task 12. Additional Meetings, Public Input Workshops and Reply Comments

The expansion of the work scope associated with Tasks 9-11 will necessitate additional meetings, workshops and reply comments. This task was approved by the Commission's November 13, 2001 ACR.

Project Team

The Phase 4 project team will consist of RER and RHA. The project team will work under the supervision of the Standardization Team and its technical advisors.

Schedule

The recommended schedule for the basic Phase 4 work scope (Tasks 1-8) is presented below in Table 1. This schedule assumes that Phase 4 is authorized by December 30, 2001.

Table 1: Phase 4 Schedule

Task and Deliverable	Completion Date
Task 1. Review Literature Submit Draft Literature Review to Standardization Team Submit Final Literature Review to Standardization Team	February 15, 2002 February 28, 2002
Task 2. Survey Practices in Private Industry Submit Draft of Survey Results to Standardization Team Submit Final Survey Results to Standardization Team	March 10, 2002 March 30, 2002
Task 3. Review Existing Data from Other Sources Submit Draft Analysis to Standardization Team Submit Final Analysis to Standardization Team	April 1, 2002 May 1, 2002
Task 4. Prepare On-Site Survey Plan Submit Sampling Plan to Standardization Team Submit Draft Survey Forms to Standardization Team Submit Draft Survey Protocols to Standardization Team Finalize On-Site Survey Plan Train Surveyors	 January 15, 2002 January 30, 2002 January 30, 2002 February 15, 2002 February 28, 2002
Task 5. Conduct On-Site Survey Complete 20% of On-Sites Complete Remaining On-Sites	 March 30, 2002 November 30, 2002
Task 6. Analyze On-Site Data Submit Interim Survey Results to Standardization Team Submit Draft Survey Report to Standardization Team Submit Final Survey Report	 April 30, 2002 November 15, 2002 December 10, 2002
Task 7. Prepare Phase 4 Report Draft Report to Standardization Team Draft Report to Public Final Report to Commission	 December 30, 2002 February 15, 2003 April 4, 2003
Task 8. Meetings, Workshops and Reply Comments	Throughout the process

The schedule for the additional work scope authorized by the November 13, 2001 ACR (Tasks 9-12) is presented in Table 2.

Table 2: Phase 4 Schedule (Additional Work Scope)

Task and Deliverable	Completion Date
Task 9. Develop Recommendations for Pre-Approval Policies Develop draft recommendations Distribute draft recommendations to public Submit final recommendations to Commission	 December 30, 2002 February 15, 2003 April 4, 2003
Task 10. Assess Current LIEE Measures	Within 90 Days Of The Commission's Final Determinations On An Assessment Methodology
Task 11. Prepare Installation Standards for Refrigerator Grounding Submit final recommendations to Commission	January 15, 2002 As soon as possible thereafter
Task 12. Additional Meetings, Workshops and Reply Comments	throughout the process

Proposed Budget

The proposed budget is presented in Table 3.

Table 3: Phase 4 Preliminary Budget

Task	Budget		
	RER	RHA	Total
Basic Work Scope			
1. Conduct Literature Review	24,480	10,796	35,276
2. Survey Practices in Private Industry	11,560	1,000	12,560
3. Review Data from Other Sources	33,000	4,926	37,926
4. Prepare On-Site Survey Plan	11,000	7,776	18,776
4a. Purchase 30 Data Loggers		30,000	30,000
5. Conduct On-Site Surveys	5,360	1,022,200	1,027,560
6. Analyze On-Site Data	33,600	15,620	49,220
7. Prepare Phase 4 Report	37,200	10,275	47,475
8. Meetings, Workshops and Reply Comments	36,480	16,000	52,480
Additional Work Scope			
9. Develop Recommendations for Pre-Approval Policies	22,600	12,000	34,600
10. Assess Current LIEE Measures	50,600	4,000	54,600
11. Prepare Installation Standards for Refrigerator Grounding	0	6,200	6,200
12. Additional Meetings, Workshops and Reply Comments	22,800	3,800	26,600
Total Phase 4	**288,680**	**1,144,593**	**$1,433,273**

(END OF ATTACHMENT 1)